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[45] **Apr. 18, 1972**

[54] PNEUMATIC PHRASE/FORMAT WRITER UTILIZING CARD CARTRIDGE AND FEATURING CYCLICAL MECHANISM FOR READING A SUCCESSION OF CARDS AS WELL AS PROGRAMMING THE TABULATION AND OTHER FUNCTIONS OF AN INTERCONNECTED PRINTER

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[52] **U.S. Cl.** **197/20**, 340/174.1

[51] **Int. Cl.** **B41j 5/36**

[58] **Field of Search** 197/20; 340/174.1

[56] **References Cited**

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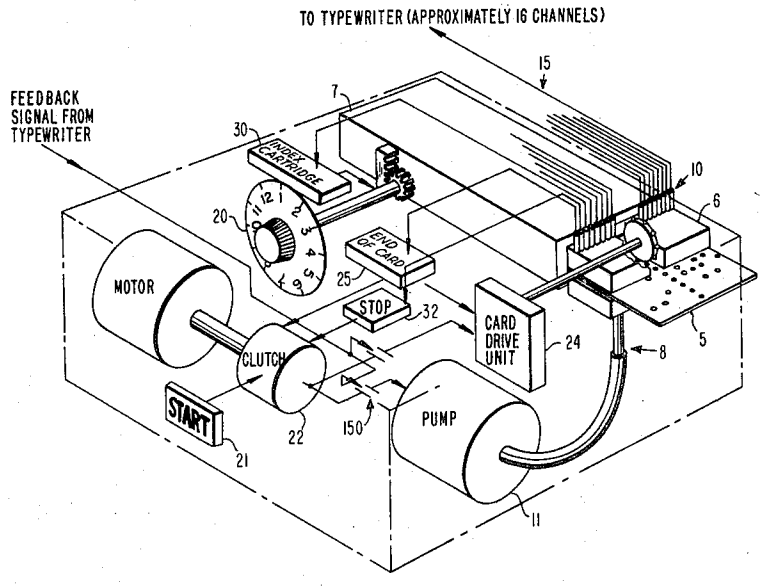
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[57] **ABSTRACT**

The present invention involves a pneumatic card handling unit accommodating a cartridge with a plurality of cards therein having information in the form of coded perforations that are pneumatically sensed. The unit includes means operable during successive cycles to withdraw individual cards in succession from the cartridge, read the information, and return the cards to the cartridge. A printing means such as "Selectric" typewriter (IBM registered trademark) is interconnected by a pneumatic cable with the card reading unit for printing of information automatically under control of the card unit. The system further includes means for controlling tabulation functions of the printer according to diverse program cards during the printing process. Also, interlock means are provided to insure completion of operations requiring a relatively longer period of time, such as carriage return and tabulation.

2 Claims, 9 Drawing Figures



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SHEET 1 OF 4

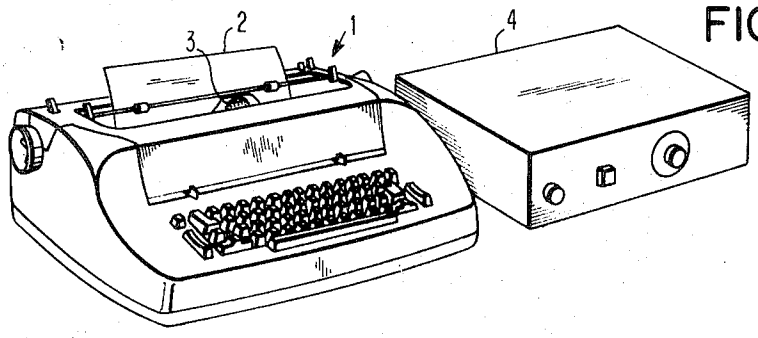


FIG-1

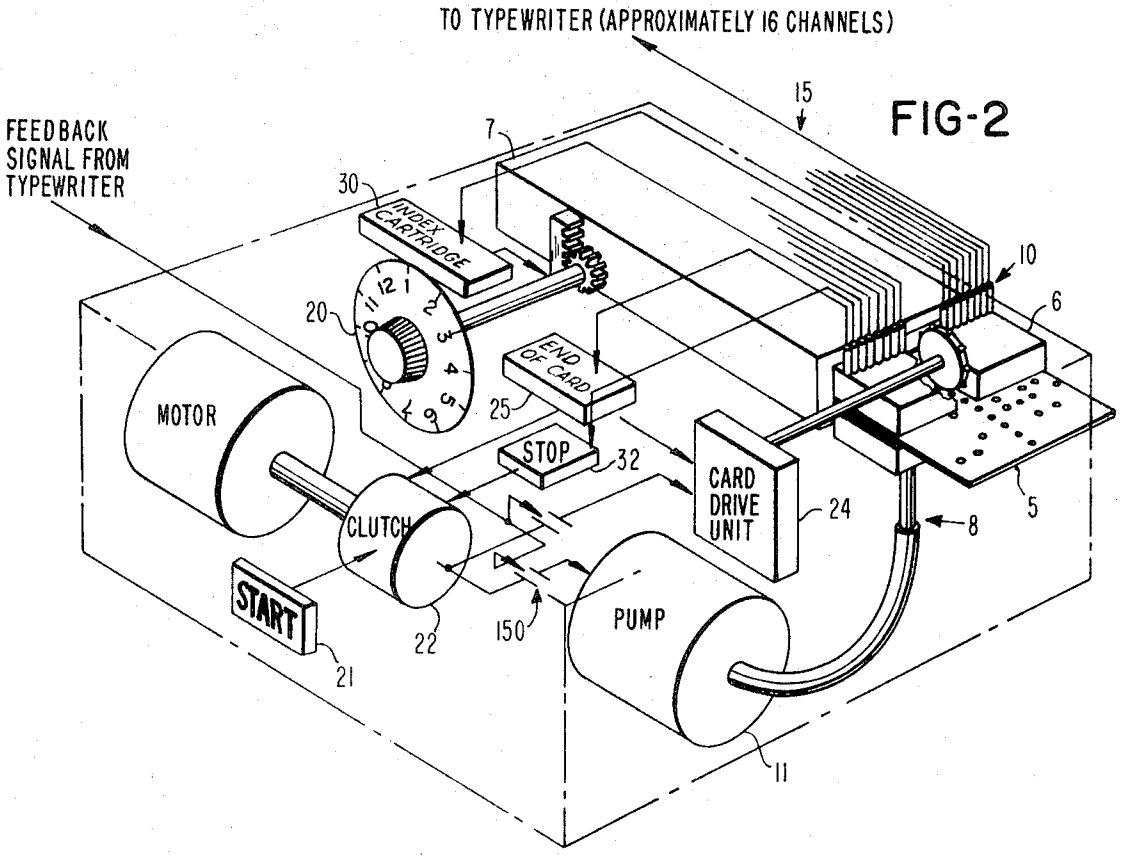


FIG-2

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FIG-3

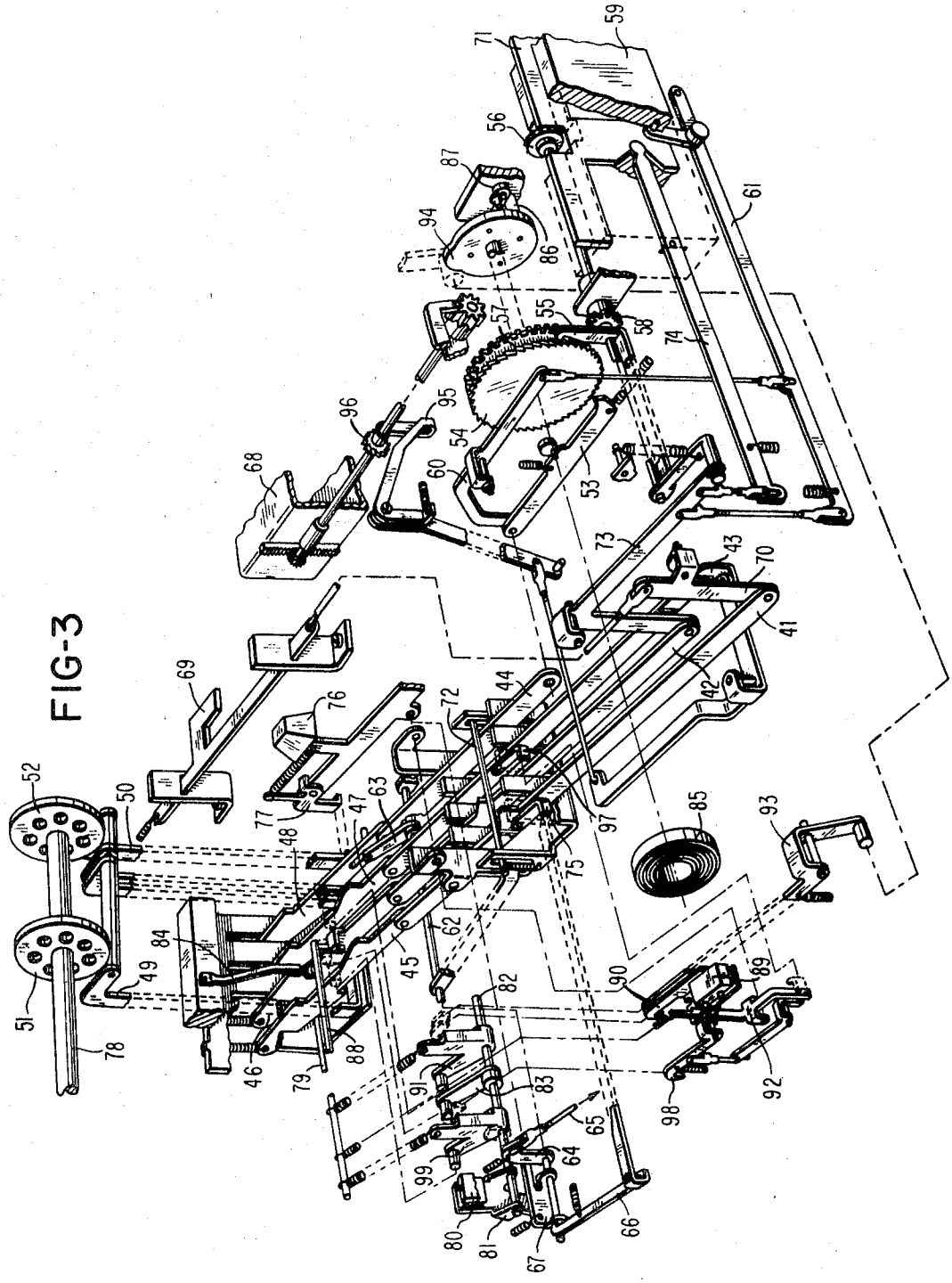

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49
82
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91
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67
66

FIG-4

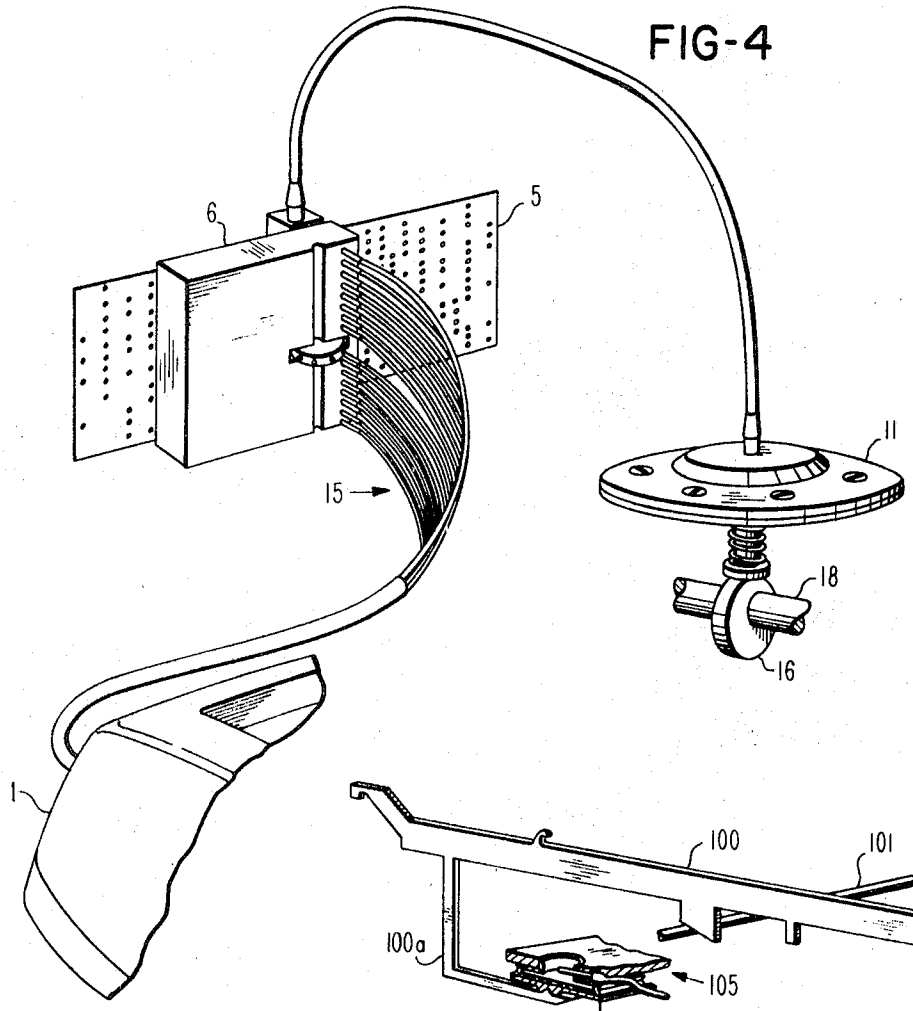


FIG-5

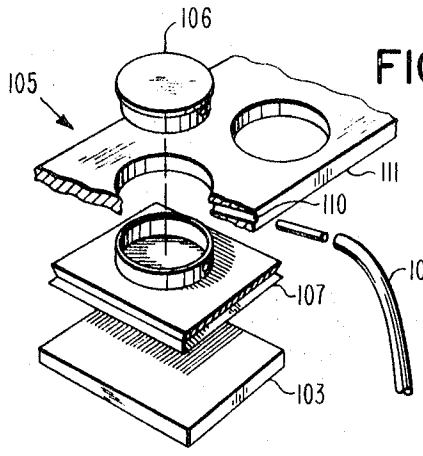


FIG-6

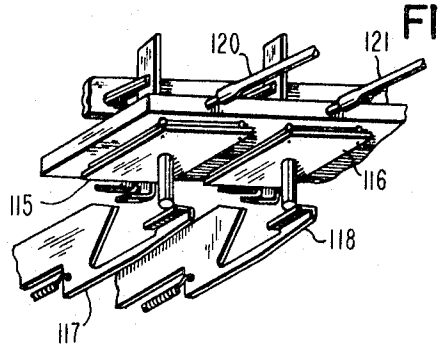


FIG-7

FIG-8

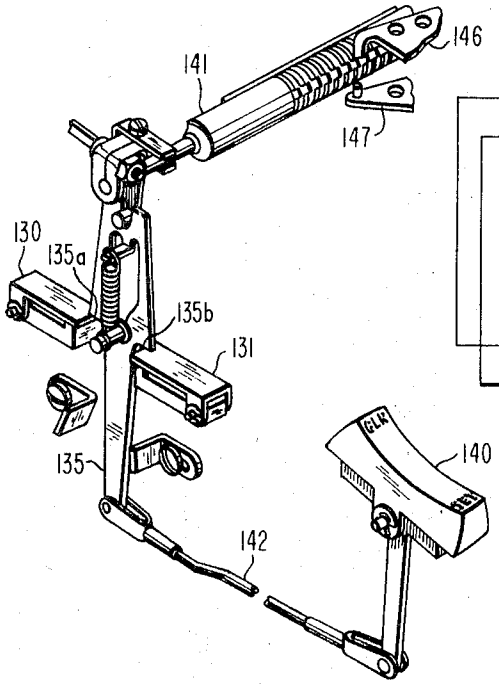

141
146
147
130
135a
135b
131
135
140
142

FIG-9

PRINTER
CARRIER RETURN
TAB
155
1
156
6
PNEUMATIC HEAD
152
PUMP
FIRST MOTION OF CARD INDEX MECHANISM
157
158
51
78
151
153
65
49
64
44
154
150
48
63

PNEUMATIC PHRASE/FORMAT WRITER UTILIZING CARD CARTRIDGE AND FEATURING CYCLICAL MECHANISM FOR READING A SUCCESSION OF CARDS AS WELL AS PROGRAMMING THE TABULATION AND OTHER FUNCTIONS OF AN INTERCONNECTED PRINTER

CROSS-REFERENCE SECTION

U.S. Pat. No. 2,919,002, L. E. Palmer, inventor, "Selection Mechanism for a Single Printing Element Typewriter," filed Apr. 19, 1957.

U.S. Pat. No. 3,297,124, D. E. Sims, inventor, "Data Recording and Printing Apparatus Capable of Responding to Changed Format," filed June 25, 1964.

BRIEF BACKGROUND OF INVENTION, FIELD, AND PRIOR ART

Apparatus has been provided in the prior art for controlling a print means under control of pneumatic devices of various kinds, some of which have been responsive to perforated media. The devices have been characterized in many cases by relative complexity for doing the particular job required as well as being structurally quite different from the apparatus contemplated in the present case. Also, in many cases, the systems in the prior art have not had all of the features considered desirable from an operator's point of view, including the automatic changing of tabulation functions under card control, as set forth in the present case.

SUMMARY OF INVENTION

The present invention contemplates a pneumatic phrase and format writing system including a "Selectric" printer, or comparable printing means interconnected by pneumatic cable with a card reading unit. The printer is operated automatically in response to code pressure signals derived from the card reader to print documents as in accounting, bookkeeping, and similar operations. In many cases, while printing a document, the tabulation stops are appropriate for one portion of the document but not for another. In accordance with the present invention, the system includes automatic tabulation control facilities responsive to card media in the card unit to change the tabulation configuration in a real time fashion as printing proceeds in order that the proper tabulation arrangement exists in the printer for a particular job or a particular portion of a document. The system is characterized by an IBM "Selectric" printer that is modified in a simplified manner to operate under control of pneumatic signals. The card unit is positioned for ready access in proximity to the printer and includes a number of controls related to card selection, card ejection, etc. The card unit has means for accommodating a cartridge that, for example, may contain up to 12 Mylar*(*trademark of DuPont Corporation) cards that are accessed in succession during operation of the unit, sensed automatically by the pneumatic reading means in the unit and that thereby provide pneumatic signals to the printer for automatic printing of desired phrases as required during operation.

The card unit includes a motor driving means with associated clutch members for operating various card handling mechanisms in the unit in an efficient cyclical fashion in order that the individual cards in the cartridge are obtained, one by one, read, and returned to the cartridge. The unit has a pump that establishes a required amount of pressure for operating pressure sensors as determined by the appropriate positioning of the sensing means in the card unit during reading of a card. The unit is connected through 16 pressure tubes or channels to the printer to operate the print head by rotating and tilting it as taught in the Palmer patent and to operate the various functions of the printer during card sensing operations. The card unit further includes a card selector dial with designations one-twelve, as an example, for selecting individual ones of the 12 cards in a cartridge positioned in the unit. Other controls include an incremental card driving unit, an end-of-card control, a start control, as well as a stop control. As will be seen, the system further includes means to interlock the card unit and prevent further operation of it when codes have been sensed, such as Carrier Return codes and Tabulation codes that require a greater amount of time for completion by the printer. Other features of the system will become evident during discussion of the embodiment disclosed herein.

OBJECTS

An object of the present invention is to provide a system for printing frequently encountered phrases and controlling format requirements during the printing of documents in an automatic fashion.

A further object of the present invention is to provide a system of this nature with certain operator oriented control adjuncts enabling selective control of the system.

A further object of the present invention is to provide an automatic printing system incorporating facilities for sensing perforated record media and preparing printed documents under pneumatic control signals derived during the sensing of the media.

Another object of the present invention is to provide tabulation control facilities in a printing system operable in response to tabulation program signals derived from perforated media.

A further object of the present invention is to provide an automatic printing system operable in response to pneumatically sensed media with provision for handling a plurality of media in succession in order to expand the amount of information that the system can accommodate.

A still further object of the present invention is to provide a system of this nature having simplified mechanisms operable in a highly efficient manner in a cyclical mode and including interlocking facilities to insure the completion of functions required by sensed code signals such as Carrier Return and Tabulation operations of an associated printer.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of the preferred embodiment of the invention as illustrated in the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 illustrates an automatic phrase and format system including a printer interconnected by a pneumatic cable with a card processing and sensing unit.

FIG. 2 is a diagramatic representation of the card unit of FIG. 1.

FIG. 3 expands on FIG. 2 by showing additional details particularly involving the mechanical portions of the card unit of FIG. 2.

FIG. 4 illustrates a possible configuration for a pneumatic cable interconnecting the card unit and the printer with the card sensing facilities.

FIGS. 5, 6, and 7 illustrate keyboard interposer actuators, a pneumatic cell, and functional actuators in the printer of FIG. 1, respectively.

FIG. 8 illustrates a tabulation set and clear mechanism together with pneumatic operating means used in the printer of FIG. 1.

FIG. 9 illustrates an interlocking facility incorporated in the system of FIG. 1 showing some of the same mechanical elements previously shown in FIG. 3.

CODE SET

The following code set is used in the system:

1. Typewriter codes
   - R1, R2, R2A, R–5, T1, T2 } Character rotate and tilt seletion codes
   - CC – Cycle Clutch
   - CR – Carrier Return

IN – Index
BS – Backspace
SP – Space
UC – Upper Case
LC – Lower Case
Set Tab
Clear Tab
Tab

2. Card Unit Codes
End of Card
Step Card
Stop Card

GENERAL SYSTEM DESCRIPTION

Referring to FIGS. 1 and 2, the pneumatic phrase/format writer system includes a typewriter 1 which is capable of printing on a document 2 automatically on command—a phrase, a paragraph, or a short letter. It is also capable of positioning a print element 3 at any desired horizontal location on document 2.

The typewriter is preferably a "Selectric" printer, such as that set forth in the Palmer patent, which has been modified to accept commands in the form of pneumatic pulses. A small card reader module 4 generates these commands. The typewriter and module are connected by a cable 15, shown in FIG. 4, containing the tubes through which the pneumatic pulses are transmitted. At the typewriter end of this cable is a coupling which enables disconnection of the typewriter from the module for stand alone applications.

Typewriter 1 has been modified to accept pneumatic print commands by inserting seven additional print interposers between the existing interposers (FIG. 5) in the keyboard. Each of six of these interposers corresponds to one of the six selection bails. For example, if the T1 tilt interposer is pulled down then the T1 bail is operated when the machine is cycled. If the T1 and R1 (rotate) interposers are pulled down, then both the T1 and R1 bails are operated when the machine is cycled. By pulling on various combinations of these six additional interposers, any character can be selected with the exception of that character selected when no bails are moved, the hyphen (-). Hence, a seventh interposer is provided which trips the typewriter cycle clutch to select this character. These additional interposers are actuated when a pneumatic pulse inflates a small rubber bellows (FIG. 6) which is attached to each of them.

In order for the machine to accept pneumatic signals for the operational functions, the mechanisms for each function are modified so that in addition to being capable of actuation in the normal manner, they can also be actuated by pneumatic actuators, as in FIG. 7. As an example, the shift function is obtained by providing a bellows operated latch mechanism so that when an Upper case command is received the latch mechanism is latched into the Upper case mode. Typewriter 1 then remains in the Upper case mode until this latch mechanism is unlatched. The mechanism is not unlatched until a Lower case pneumatic signal is received.

In order to make the machine particularly adaptable to forms work, typewriter 1 includes mechanisms for remotely setting and clearing tab stops, FIG. 8. A set of rubber bellows is located directly adjacent the tab set-tab clear arm in FIG. 8.

The text to be automatically printed out by the typewriter is stored on pre-punched mylar cards 5 which are about the size of an IBM card. The cards are stored in plastic cartridges 7 which have a capacity of 12 cards. These cartridges are removable from the card unit 4 so that an entire new set of programmed cards can be inserted into the machine simply by removing one cartridge and inserting another.

The information punched on each card is read by means of a pneumatic read head 6 contained in the card module. The pneumatic read head is made up of an input manifold 8 and an output manifold 10. The input manifold takes an air pulse from a pump 11, which is also contained within the module, and allows it to exit through approximately 20 small "read holes" on the reading surface of the head. The output manifold also contains approximately 20 small "read holes" which correspond to those in the input manifold. On the output manifold each "read hole" is provided with a fitting whereby a flexible tube can be connected to it. Each of these "read holes" or channels correspond to one particular function that is to be performed, i.e., there is one channel for Backspace, one for Carriage Return, one for a T1 selection, one for an R1 selection, etc. So if a card is put between the input and output manifolds, then all channels are blocked except the one or ones where holes in the card allow the pneumatic pulse to pass through. By this means, the holes punched on the card are read without using any logic circuits, since there is a channel present for every function to be performed. The output from the head is in the form of a bundle 15 of flexible tubes which convey the pneumatic pulse to the appropriate actuators in typewriter 1.

As each station on the card has been read, the card is indexed by the card drive unit to the next station so that it can be read. The card continues to be indexed and read until the head reads an "End of Card" code which will cause the card drive unit to return the card into the cartridge.

Pump 11, which generates the air pulse used in reading the card, is a diaphragm-type pump. It is driven by a cam on a timing shaft 18, FIG. 4. This cam is oriented so that one pulse is emitted for each cycle of shaft 18. The card drive unit 24 also receives its power from a cam on this same timing shaft, so that the time elapsed between reading the card and indexing it to the next set of holes always remains the same.

In order to select a card for play-out, a cartridge 7 is positioned with respect to head 6 so that the card can be pushed out of the cartridge and go directly between the input and output manifolds of head 6. Position selection is accomplished by turning a dial 20 on the module to the desired location. Rotation of this dial causes cartridge 7 to be raised or lowered to a point where the selected card is aligned with the head. To play out a card, action is initiated by depressing a Start button 21 located on the module. This causes the clutch 22 to become engaged, which in turn causes the selected card to be engaged with the card drive unit 24. The card is then indexed and read in the manner described above. Pulse pump 11 and card drive unit 24 continue to function until an "End of Card" code is read by means 25 which will disengage the clutch and restore the entire machine to a standby condition.

Functions which take longer than the timing shaft cycle such as Index Carriage Return, and Tab require some means of delaying new commands from the module until the completion of these longer operations. This has been accomplished by providing a pneumatic feedback loop, FIG. 9, which prevents the card from indexing to the next station and also prevents the exit of signals from the head until the operation is completed.

For some applications there is a requirement for more characters than can be stored on one card. Applications of this sort suggest the use of two or more cards. It is desirable in cases of this sort for each card associated with a particular program to be automatically played out at the completion of the one preceding it. This is made possible by programming a "Step" code into a card which is to be automatically followed by another one. The "Step" code conditions the machine by index means 30 so that as soon as the card that is now being read is returned into the cartridge, the cartridge automatically indexes to the next card position and proceeds to play out the card corresponding to that position.

One of the channels in the pneumatic read head is for the purpose of stopping the card at some designated spot. When a hole punched in a card lines up with this channel, it is referred to as a "Stop" code. When the head reads the Stop code, the card stops and remains so until Start button 21 on the module is again depressed. This is accomplished by having a flexible tube connecting this channel with a pneumatic actuator 32 which disengages the clutch, thereby stopping the card reading operation. This feature is useful for entering variable data into the middle of a phrase, such as the date.

A projected use for the system is the powered typing of material which rarely changes from day to day, and it may be acceptable to prepare the cards on an inexpensive hand punch. If it is found that a large number of the cards are to be prepared, then it is possible that the punch can be mechanized and hooked to a magnetic tape system such as that described in the Sims patent, for rapid production.

CARD HANDLING UNIT OPERATION

The card handling unit consists of four slides **41, 42, 43,** and **44** to which are attached various mechanisms and linkages. Each mechanism performs an operation associated with the card handling sequence. Each slide is selectively driven by means of pawls **45, 46, 47,** or **48**. A slide is driven when one of these pawls becomes engaged with follower **49** or **50**, which, in turn, are driven by cams **51** and **52**, respectively.

The card handling sequence is initiated by depressing keybutton **76**, which results in dobber **77** contacting pawl **45**, and the subsequent engagement of same. Before pawl **45** is depressed by the button **76**, there is no power to the operational shaft **78**, so therefore, engagement of pawl **45** causes engagement of the clutch through which the operational shaft is driven. This is done by a rotation of the torque bar **79**. This rotation is effected just after pawl **45**, which is being pushed down manually, contacts a small tab attached to torque bar **79**. Dobber **77** is provided to prevent pawl **45** from being driven more than once, should the button be held in the depressed position.

Programmed cards are stacked in a removable cartridge held by cartridge holder **68**. Engagement of pawl **45** causes one of these cards to be pushed from the cartridge and between the movable head **59** and a stationary head (not shown) directly above it. As soon as the card is between the heads, it is clamped. This clamping forces the sprocket holes in the card to become engaged with the sprocket **56**. The card is pushed out of the cartridge by card pusher **69**, which in turn is driven by slide **41** through bellcrank **70** and a link. To ensure that the card is in the right position for the first character to be read and to insure that when the heads clamp together on the card the sprocket holes in the card line up with the pins on the sprocket wheel, a card stop **71** is provided against which the card is pushed by card pusher **69**. In order for a card to be pushed between the stationary head and the movable head **59**, the heads must be in the unclamped position so there will be an opening between them. The heads are held in the unclamped position by a protrusion on slide **42** which is latched behind latch bar **72** as shown in FIG. **3**. If latch bar **72** is raised so slide **42** is no longer held in a driven position, the spring attached to arm **61** is allowed to pull arm **61** upwardly resulting in the clamping of the heads together. The motion of slide **42** is transmitted to arm **61** through a bellcrank **73** and a link. Also connected to this bellcrank is a link which transmits motion to lever **74**. When slide **42** is unlatched, lever **74** is compelled to move in such a manner as to lower card stop **71** into the movable head. It is noted that this stop must be lowered to allow the card to be indexed by sprocket **56**. There is also a protrusion on slide **41** which is on the other side of the latch bar **72**. If slide **41** is driven, the inclined surface of this protrusion forces latch bar **72** upwardly. By proper adjustment, latch bar **72** is made to unlatch slide **42** just after the card is pushed between the heads and against card stop **71**, resulting in clamping the card and engaging the card with the sprocket. In addition to the above-noted functions, motion of slide **41** results in the engagement of pawl **48** with follower **50**. This is accomplished when tab **75**, attached to slide **41**, contacts latch **66** and causes it to unlatch keeper **67** allowing arm **64**, which is spring biased toward the pawl engaged direction, to rotate. The rotation of arm **64** is transmitted to arm **63** through torque bar **62**, resulting in engagement of pawl **48**.

With pawl **48** engaged with follower **50**, the unit is now ready to perform the card indexing operations. These operations consist of three parts. The first is unclamping the heads which permits the card to move without damaging the sprocket holes when sprocket **56** is rotated. The second is the actual rotation of sprocket **56** which indexes the card to its next set of holes. The third and last part of the card indexing is the reclamping of the card between the heads so it may be read with a pneumatic pulse.

As pawl **48** is driven, it pulls slide **44** which in turn causes bellcrank **60** and arm **61** to move in such a way as to unclamp the card. As slide **44** continues, its motion, pawl **53** engages ratchet **54** and advances one tooth; it also advances sprocket **56** one tooth through gears **57** and **58**. When a card is engaged with sprocket **56**, it will be stepped one unit for each rotation of cam **52**. As pawl **53** is returned to its normal position, backward rotation of the ratchet is prevented by check pawl **55**. When pawl **53** and slide **44** have returned completely to the normal position, the heads have also returned to the clamped position and the card is ready to be read. The card indexing operation will continue in this manner until pawl **48** is disengaged.

Disengagement of pawl **48** is brought about in one of two ways. The first of these ways is when an End of Card code is read from the card. This causes a pneumatic pulse to be sent to bellows actuator **80**, resulting in motion of armature **81**. This motion in turn causes keeper **67** to rotate in such a way as to disengage pawl **48** through the same linkage through which it was engaged. When the pulse is removed from bellows actuator **80**, keeper **67** is held in the pawl disengaged position by latch **66**. Pawl **48** can also be disengaged by motion of link **65**. (The function of link **65** is described elsewhere herein and pertains to a feedback mechanism for the pneumatic phrase/format writer.) When disengaged by link **65**, pawl **48** is allowed to become engaged again as soon as the link is restored to its normal position. For this reason, it is necessary for keeper **67** to be able to rotate freely on torque bar **62**; so when arm **64** is pulled into the pawl disengaged position by link **65**, it is not latched there by members **66** and **67**.

When the End of Card signal is sent to the bellows actuator **80** resulting in motion of armature **81**, it, in addition, transmits motion to arm **83** through torque bar **82**. Motion of arm **83** causes pawl **46** to become engaged with follower **49**. This pawl is held in engagement by spring finger **84** until it is driven. When this pawl is driven, it causes the heads to unclamp, lets the card return into the cartridge, and disengages the clutch. The heads are unclamped through motion of arm **61**, as previously described. Once the slide **42** is driven, causing motion of arm **61**, it remains in the driven position due to its being latched by latch bar **72**. In addition to causing motion of arm **61**, bellcrank **73** causes check pawl **55** to be lifted from ratchet **54**. When this is done, the ratchet is compelled to turn backwardly due to the spring bias provided by clock spring **85**. The ratchet continues to turn backwardly until peg **86**, which is attached to the ratchet, contacts the ratchet stop **87**. This backward motion causes sprocket **56** to also turn backwardly, causing the card to be driven back into the cartridge. When bellcrank **73** is driven by slide **42**, it also allows lever **74** to be acted upon by the spring attached to it. This spring causes the card stop **71** to exert pressure on the card in the upward direction, thereby holding the card in engagement with sprocket **56** while it is returning into the cartridge. As soon as the card completely returns, card stop **71** is allowed to continue its upward travel so it is in position to act as a stop for the next card pushed out. In order to disengage the clutch when pawl **46** is driven, a small tab is bent out on that pawl which contacts another small tab projecting downwardly from torque bar **88**. As pawl **46** is driven, it transmits a torque through this bar which disengages the clutch.

Pawl **47** and its associated mechanisms are provided for the purpose of automatically stepping from one card to another. This action is triggered by a Step code in the form of a pneumatic pulse which is read from a card which is to be followed by another one. This pulse is routed to bellows actuator **89** which unlatches latch **90** from bellcrank **91**. Latch **90** is held in the unlatched position, after the pneumatic pulse is withdrawn, by latch **92**. Even though latch **90** is pulled from

bellcrank **91**, the bellcrank still remains in the same position because it is being held by latch **93**. Latch **93** is unlatched by a high point on cam **94**. This cam is set so that latch **93** can only be unlatched when the cam is in the "home" position. This is to prevent the cartridge from being stepped until the card presently being read is returned into the cartridge. When latch **93** is unlatched, the spring attached to bellcrank **91** causes it to rotate and thereby engage pawl **47** with follower **49**. Since the final latch on bellcrank **91** is tripped off after the clutch is disengaged, there is no power available to drive pawl **47**. Therefore, another tab has been provided on torque bar **79** so when pawl **47** engages follower **49**, it will also impart a torque to torque bar **79** which in turn engages the clutch. When pawl **47** is driven, it causes pawl **95** to engage with ratchet **96** and drive it one tooth. Rotation of ratchet **96** one tooth in turn causes the cartridge contained in cartridge holder **68** to be stepped down one notch so the next card is now lined up with the heads and card pusher **69**. In order to prevent the cartridge from being stepped down more than one position, means are provided to restore pawl **47** after it is driven through a cycle. In order to restore the pawl to the disengaged position, it is necessary that bellcrank **91** again become latched. To do this, the bellcrank is first restored to a position where it is latched by the motion of an inclined surface on pawl **47**. Once in position, the bellcrank is latched by dropping latch **90** into place. Latch **90** is allowed to drop into place when latch **92** is unlatched by the motion of tab **97** on slide **43**. Motion of tab **97** also causes latch **98** to become disengaged from bellcrank **99**. When bellcrank **99** is unlatched, the spring attached to it causes it to engage pawl **45** with follower **49**. This in turn causes the card to be handled as described before when pawl **45** is engaged. To prevent pawl **45** from being driven more than once, it is necessary that bellcrank **99** be latched up. This is done just as with bellcrank **91** by an inclined surface on the driven pawl which, in this case, is pawl **45**.

PRINTER MODIFICATIONS

FIGS. **5** through **8** illustrate some modifications made to the printer as previously indicated in the system description. In FIG. **5**, a keyboard interposer **100** is arranged for cooperation with a bail **101** involved in selecting the rotate and tilt movement of the print head **3** in printer **1**, FIG. **1**. Extending from interposer **100** is an extension **100***a* having a flat member **103** forming part of a pneumatic actuator assembly **105**. A typical assembly **105** is illustrated in FIG. **6** as involving a cylindrical member **106** fitted tightly in a bellows **107** and arranged for operation by pneumatic impulses in tube **108** directed in opening **110** of a plate **111**. An impulse into the actuator expands bellows **107** to move element **103**, as an example, thereby moving interposer **100** downwardly to operate bail **101** to effect the desired operation. FIG. **7** illustrates other pneumatic actuators **115** and **116** with associated function interposers **117** and **118**. The related pneumatic tubes are designated **120** and **121**, respectively.

In FIG. **8**, the tab set and clear mechanism, as provided in the IBM "Selectric" printer, is modified by the addition of actuators **130** and **131** positioned adjacent portions **135**a and **135**b of the tab set and clear arm **135**.

Printer **1** has a Set-Clear keybutton **140** arranged to set and clear stops in the rack **141** as shown in FIG. **8**. An individual tab stop is set by moving print head **3** to the desired tab location and depressing keybutton **140** at the Set End. This operates a link **142** and the Set and Clear arm **135** and rotates rack **141** in a counterclockwise direction. As rack **141** rotates, the tab stop corresponding to the desired location strikes the escapement bracket projection **146** which rotates the stop in a clockwise direction in relation to the other tab stops on rack **141**. Thereafter, the set stop is effective to encounter a finger on the head carrier as print head **3** moves to the right in FIG. **1** and thereby stop print head **3** in the desired location so long as the tab stop remains set.

To clear a previously set stop, print head **3** is again moved to the tab location to be cleared and the clear portion of keybutton **140** is depressed. This operates the set and clear arm **135** to rotate rack **141** clockwise. A tab stop that has been set encounters the escapement bracket projection **147** and is effectively moved counter-clockwise to its normal home position which it assumes when keybutton **140** is released. Thereafter, the stop is out of the way of the pin on the head carrier and is ineffective.

FORMAT DIAGRAM

Format diagram A is presented below to illustrate the tabulation control:

FORMAT A

Name of Vendor	Date
Acme Tool and Die Co. 127 W. 2nd Street Kansas City, Kansas	Nov. 18, 1968
Type Orders Special	Date Required Nov. 30, 1968
Special Instructions Deliver to Bldg. 985	

Description	Part No.	Qty.	Unit Cost	Total Cost
Die Block 5"	1101AZ	3	$50.00	$150.00

CARD LAYOUT FOR FORMAT A

Card 1

SP SP SP SP SP TAB SET UC A *LC* CME *SP UC* T *LC* OOL *SP* AND *UC* D *LC TAB SET* IE *SP UC* C *LC* O . *SP SP SP SP SP SP SP SP SP SP TAB SET SP SP SP SP SP SP TAB SET SP SP SP SP SP SP SP SP SP SP SP SP TAB SET STOP CR TAB* 1 2 7 *UC* W *LC* . *STEP EC*

Card 2

SP 2ND *SP UC* S *LC* T . *CR TAB UC* K *LC* ANSAS *SP UC* C *LC* ITY , *SP UC* K *LC* ANSAS *CR IN TAB STOP TAB TAB TAB STOP CR IN IN TAB TAB TAB UC* D *LC* ELIVER *SP* TO *SP UC* BLG *LC* . *SP* 985 *CR IN IN IN TAB EC*

DESCRIPTION OF FORMAT A AND CARD 1 AND 2 LAYOUTS

Format A shows a format which might be used under card control for setting tabs, clearing tabs, tabbing, and indexing. The form illustrated has the name of a vendor which is commonly used, the date, the date required, and type of order. Under the "special instructions" block shown on this particular form are instructions that might be the same every time the form is prepared. The other information on the form is all variable information. In order to position the items at their proper points on this particular form, tab stops have to be set at corresponding locations. The card layouts **1** and **2** will do this in an efficient manner.

Since the name of vendor is indented, Card 1 has a series of spaces followed by Tab set code for the beginning of the name. After "Tool and Die Company" is typed, the printer is spaced over to the "date." Spaces and tab set codes are in the first line information on Card 1 to set tab stops for use in later lines. Program stop codes are provided in Card 1 (and Card 2) so the typist can enter variable data. Carrier return codes are also included in the card. The typist proceeds to type the second line, the third line, and another stop code is encountered. She enters the type of order. She proceeds to "date required." The Tab stop for "Unit cost" might be the same for "date required." If it were not, that is, if it were some place between these two, the card would include an extra Tab set code for "date required" in the first line followed by spaces to get to the "date" location. Later, as soon as that tab stop is used, a Tab clear code is programmed to clear it.

Thus, the tab stops required may preferably be set up in the first line of the form. Later, since the previously programmed tab stops are known, the necessary tab codes are provided in the card to position the carrier at the desired point. At the end of the "total cost" line, all the tabs may be cleared by programming the card with Tab, Tab Clear, Tab, Tab Clear, Tab, Tab Clear, etc. By using that sequence, all tab stops which were previously set can be cleared. Another possibility is to leave them all set, and the typist would know that before she uses another program card, she has to gang clear all tab stops. This is done manually. She may wish to do that anyway in order to insure there is no tab stop set prior to the first line.

It is seen with the arrangements of the present system that the tabulation control is effected in an efficient and flexible manner and is easily changed depending upon the requirements of the job application.

FEEDBACK AND INTERLOCK FEATURE

In the pneumatic system herein, it is contemplated that the reading cycle for an individual character in read unit **4** takes slightly longer than the cycle time of the printer. As an example, if the printer cycle is 65 milliseconds, the reader can be arranged to cycle slightly longer such as 80 milliseconds in order that it does not send information to the printer faster than the printer can handle it. In this fashion, no interlocking is ordinarily required since the printer is always ready for the next character when received from the card unit.

Under some circumstances, however, such as the point of recognition of a Carrier Return code, Tab code, and the like, a longer cycle is involved and it is necessary to interlock the printer and the card unit as illustrated in FIG. **9** to insure that the card unit does not send additional characters or commands until the printer is ready for them. This is done by preventing the card from being indexed until the aforementioned operations are completed.

The interlock is accomplished by switching a bistable pulse diverter **150** from the normal mode, as shown in FIG. **9** to the interlock mode. Pulse diverter **150** is switched by an air pulse to interlock bellows **151**. This interlock air pulse is generated any time the card reads a Carrier Return, Tab, or Index. When pulse diverter **150** is switched, it causes the output of pump **152** to be diverted from the head into a feedback loop. If the feedback loop is open, the next pump pulse causes feedback bellows **153** to be actuated and restores armature **154** to the normal side. (This is the case for Index. Since it is only a 130 ms cycle, the card reading need only be delayed for one Reader cycle to allow the Index operation to be completed.) If either Carrier Return feedback valve **155** or tab valve **156** are closed, the pulse terminates at that point. Carrier Return feedback valve **155** is closed at the beginning of a Carrier Return operation and is not opened until the operation is completed. Therefore, each pump pulse received during a Carrier Return terminates at that feedback valve, and the first pulse received after the operation is completed restores armature **154** to the normal side. The Tab feedback operation works in the same manner. Instead of two valves in series, one valve may be designed to be operated by both operations.

In addition to causing the pump pulse to be diverted, switching pulse diverter **150** to the interlock side also prevents the card from being indexed. This is accomplished by lifting index card pawl **48** from cam follower **49** through mechanical linkages **63**, **64**, and **65** as shown in FIG. **9**. When armature **154** is restored to the normal side, index card pawl **48** again engages with follower **49** causing the card indexing operation to resume.

To prevent a pump pulse from being received at the head before the card has an opportunity to be indexed immediately following a feedback operation, arm latch **157** is provided. To switch diverter **150** to the interlock mode, an arm **158** must be moved to the interlock side. When this is done, arm latch **157** falls in behind arm **158**. Now when armature **154** is restored to the normal side, arm **158** is not allowed to be restored to the normal side since arm latch **157** is in its path. Arm **158** remains in this condition and, consequently, the output of pump **152** remains disconnected from head **6** until latch **157** is lifted thereby allowing arm **158** to restore. Arm latch **157** is lifted by sensing the first motion of the card index mechanism.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in format and detail may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A pneumatic processing system for processing individual perforated media to derive signals for controlling a utilization device, such as a typewriter, said system including facilities for accommodating a media storage cartridge, said cartridge having at least a plurality of storage areas, each accommodating a medium and each medium including a group of code perforations arranged in successive sets, comprising:

pneumatic means activatable for sensing code perforations in said medium, said pneumatic means including a pair of pneumatic sensing heads movable between a clamped condition for holding a medium for sensing therebetween and an unclamped condition enabling movement of a said medium therebetween;

means for mounting a said cartridge so that said medium is generally located for movement toward said sensing means;

motive means;

clamping control means for moving said sensing heads between said clamped and unclamped conditions;

cyclically operable means, said cyclically operable means including first, second, third, and fourth actuating means of similar predetermined compact configuration, each comprising at least a respectively associated actuating member:

1. means controlled by said first actuating member for operating said clamping control means to move said sensing heads to an unclamped condition;
2. means further controlled by said first actuating member for moving a said medium from its respective storage area to said sensing means,
3. means for activating said sensing means to sense a said code perforation in said medium,
4. means controlled in each cycle by said second actuating member for (a) operating said clamping control means to move said sensing heads to an unclamped condition; (b) incrementally stepping said medium in order to position it for sensing of a set of perforations, and (c) operating said clamping control means to move said sensing head to a clamped condition, said second actuating member being operable in continuous cycles to sense successive sets of perforations to the end of the group of code perforations on said medium;
5. means (a) controlled by said third actuating member and responsive to an end of medium control signal for operating said clamping control means to move said sensing heads to an unclamped condition, and (b) to incrementally step said medium in a reverse direction in order to return said medium to its respective storage

area in said cartridge upon termination of sensing of all perforations in said medium;

clutching means associated with said motive means for interconnecting said motive means with said cyclically operable means;

start means for initiating operation of said cyclically operable means by activating said clutching means; and

means controlled by said fourth actuating member for indexing said cartridge as said medium is returned to its respective area in order to access the next medium required in said cartridge.

2. The system of claim 1 further comprising:

movable stop means located in proximity to said sensing means for stopping a medium for initial alignment prior to a sensing operation, said stop means being movable between a first condition in which it is located in the path of travel of a said medium and a second condition in which it is retracted so as to be out of the path of travel of a said medium; and

means further controlled by said first actuating member after movement of a said medium from its respective storage area to said sensing means, and alignment by said stop means for moving said stop means to its retracted condition thereby enabling movement of a said medium between said sensing heads.

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